

CLAIMS

1. A spectrometer module comprising:
  - an input, for receiving an incoming optical signal,
  - 5        -a variable differential group delay (DGD) element,  
for applying a variable birefringence retardation to  
said incoming optical signal,
  - a detector unit for detecting the power in a de-  
fined state of polarisation of a signal exiting said  
10        variable DGD element.
2. The spectrometer module as in claim 1, wherein said  
variable DGD element is implemented spatially.
- 15    3. The spectrometer module as in claim 2, wherein said  
variable DGD element comprises a plurality of later-  
ally spaced sub elements having different optical  
lengths.
- 20    4. The spectrometer module as in claim 3, wherein said  
incoming optical signal is arranged to have essen-  
tially the same width as said variable DGD element,  
thereby covering each of said laterally spaced sub  
elements.
- 25    5. The spectrometer module as in claim 4, wherein said  
variable DGD element comprises a plane incidence  
surface, being essentially orthogonal to the optical  
signal path, and a stepped exit surface.
- 30    6. The spectrometer module as in claim 2, wherein said  
variable DGD element comprises a birefringent ele-  
ment having a decreasing thickness in a direction  
being transverse to said incoming optical signal.
- 35    7. The spectrometer module as in claim 6, wherein said  
detector unit comprises an array of detectors, and a

lens is placed between said variable DGD element and said detector unit, whereby said detector array is arranged in the Fourier focal plane of said lens.

- 5        8. The spectrometer module as in claim 6, wherein said incoming optical signal is arranged to be slightly divergent.
- 10       9. The spectrometer module as in claim 1, wherein said variable DGD element is implemented temporally.
- 15       10.       The spectrometer module as in claim 9, wherein said variable DGD element is comprised in a birefringent system, being essentially sandwiched between a first and a second reflective element, whereby said incoming optical signal is arranged to be reflected between said reflective elements one or more times before outputted from said birefringent system.
- 20       11.       The spectrometer module as in claim 10, wherein said first and second reflective elements are constituted by a first and second mirror element, respectively.
- 25       12.       The spectrometer module as in claim 10, wherein said first and second reflective elements are constituted by a first and a second retroreflector, respectively.
- 30       13.       The spectrometer module as in any one of the claims 1, wherein a polarizer is arranged between said variable DGD element and said detector unit, said polarizer not being aligned relative to the birefringence eigenaxes of said DGD element.
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14. The spectrometer module as in claim 1, wherein said incoming optical signal have a polarisation so as to inject light in both birefringence eigenaxes of said variable DGD element.

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15. The spectrometer module as claim 1, wherein said variable DGD element is manufactured from an electro-optical birefringent material.

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16. The spectrometer module as in claim 15, wherein said variable DGD element is arranged between a first and a second electrode structure, said electrodes being arranged to generate an electric field over said variable DGD element.

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17. The spectrometer module as in claim 1, wherein said variable DGD element is connectable with an acusto-optic transducer.

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18. The spectrometer module as in claim 1, wherein said detector unit is connectable with an electronic processing device, in which a detected signal may be processed to extract information regarding properties such as power, state of polarisation and degree of polarisation of said incoming optical signal as a function of wavelength.

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19. A spectrometer device for measuring the optical spectrum of an optical signal, characterised in that said spectrometer device comprises a first and a second spectrometer module as described in claim 1, and a polarisation splitter, whereby said polarisation splitter is arranged to split said optical signal into a first and a second signal segments, whereby said first signal segment is arranged to be inputted to said first spectrometer module, and said second signal segment is arranged to be inputted to

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said second spectrometer module.

20. A monitor module for measuring properties such as power, state of polarisation and degree of polarisation of an incoming optical signal as a function of wavelength, said monitor module comprising:
- 5 -a polarisation control module being connected with a control unit,
  - 10 -a spectrometer module, being connected with said control unit, and
  - a polariser being placed between said polarisation control module and spectrometer module.
21. The monitor module as in claim 20, wherein said
- 15 spectrometer module comprising:
    - an input, for receiving an incoming optical signal,
    - a variable differential group delay (DGD) element, for applying a variable birefringence retardation to said incoming optical signal,
    - 20 -a detector unit for detecting the power in a defined state of polarisation of a signal exiting said variable DGD element.
22. The monitor module as in claim 21, wherein said
- 25 polarisation control module comprises:
    - a first birefringent element,
    - a second birefringent element,
    - each of said birefringent elements being connected with a power source for individual control of the
    - 30 birefringence of said first and second birefringent element, respectively.
23. The monitor module as in claim 22, wherein the
- 35 birefringence eigenaxes of said second birefringent element is not aligned in relation to the birefringence eigenaxes of said first birefringent element.

24. The monitor module as in claim 22, wherein the birefringent eigenaxes of said first and second birefringent elements are coinciding, and a quarter wave element, being non-aligned with the birefringent eigenaxes of said birefringent elements, is arranged between said first and second birefringent elements.

10 25. A unit for monitoring an optical signal, being transmitted in an optical network, said unit comprising:  
-a coupler, being arranged to be inserted along a optical transmission path of said optical network,  
15 said coupler having a main in- and output, respectively, for receiving and transmitting said optical signal and at least one drop output, to which a portion of said optical signal is droppable, said drop output being connected with one of a spectrometer  
20 module as described in claim 1 and a monitor module, as described in claim 20.

26. A monitoring system for an optical network, comprising a plurality of network elements, such as  
25 transmitters, receivers, transmission lines, amplifiers or the like, said monitoring system comprising:  
-two or more monitoring stations, each of said monitoring stations being positioned between two network  
30 elements of said optical network and each of said stations comprising one of a spectrometer module as in claim 1, a monitor module as in claim 20 and a monitoring unit as in claim 25 and  
-a monitoring hub, being connected with each monitoring  
35 station, said hub being arranged to receive measured signal data from each of said monitoring stations, and said monitoring hub comprising a proc-

essing unit for processing said measured signal data.

27. A monitoring system for an optical network,  
5 comprising a plurality of network elements, such as transmitters, receivers, transmission lines, amplifiers or the like, said monitoring system comprising:  
-two or more monitoring stations, each of said monitoring stations being positioned between two network  
10 elements of said optical network, each of said stations being arranged to measure power, state of polarisation and degree of polarisation of an optical signal entering said monitoring station via said  
15 network,  
-a monitoring hub, being connected with each monitoring station, said hub being arranged to receive measured signal data from each of said monitoring stations, and said monitoring hub comprising a processing unit for processing said measured signal  
20 data.

28. A method of monitoring and measuring properties such as power, state of polarisation and degree of  
25 polarisation of an incoming optical signal as a function of wavelength, the method comprising the steps of:  
-inputting said incoming optical signal to a variable DGD element,  
30 -applying a variable birefringence retardation to said incoming optical signal by letting it pass said variable DGD element, and  
-detecting the power of the signal exiting said variable DGD element, having a determined state of  
35 polarisation.

29. The method according to claim 28, wherein said variable DGD element, being comprised in a spectrometer module as described in claim 1.

5 30. The method according to claim 28, further comprising the step of:  
-dropping said incoming optical signal from a wavelength division multiplexed (WDM) fibre optical communication system that is to be monitored.